Bioactive glass nanoparticles (BGNPs) promote an apatite surface layer in physiologic conditions that lead to a good interfacial bonding with bone. A strategy to induce bioactivity in non-bioactive polymeric biomaterials is to incorporate BGNPs in the polymer matrix. This combination creates a nanocomposite material with increased osteoconductive properties. Chitosan (CHT) is a polymer obtained by deacetylation of chitin and is biodegradable, non-toxic and biocompatible. The combination of CHT and the BGNPs aims at designing biocompatible spheres promoting the formation of a calcium phosphate layer at the nanocomposite surface, thus enhancing the osteoconductivity behaviour of the biomaterial. Shape memory polymers (SMP) are stimuli-responsive materials that offer mechanical and geometrical action triggered by an external stimulus. They can be deformed and fixed into a temporary shape which remains stable unless exposed to a proper stimulus that triggers recovery of their original shape. This advanced functionality makes such SMPs suitable to be implanted using minimally invasive surgery procedures. Regarding that, the inclusion of therapeutic molecules becomes attractive. We propose the synthesis of shape memory bioactive nanocomposite spheres with drug release capability.

**MATERIALS AND METHODS**

To monitor the shape memory capability of the spheres, dehydrated BGNPs spheres (10% BGNPs/10% GNP) in the temporary shape were placed inside a 4 mm diameter rabbit femur defect.

For drug delivery studies, Congo Red (CR) was loaded into the spheres. The spheres were pre-deformed during 30 min by compression (R = 75%). Then, they were immersed in a solution of 10 mg mL⁻¹ of CR in PBS for 24 h. After loading, the samples were again compressed (R = 75%) and dehydrated for 30 min in ethanol and dried. After the deformation and fixation of the temporary shape, spheres were immersed in PBS. Aliquots were taken and CR was quantified by absorbance at 498 nm.

In vitro bioactivity tests were carried out in simulated body fluid (SBF) for 1, 3 and 7 days at 37°C.

**RESULTS AND DISCUSSION**

The 10 wt % BGNPs content showed a rough surface with evenly distributed BGNPs protruberances. Indicating the successful BGNPs loading in the crosslinked CHT.

Spheres with no BGNPs content and with lower crosslink (1% GNP content) showed higher strain recoveries.

Spheres were capable to maintain the deformation and to recover their permanent shape.

**CONCLUSIONS**

The composite spheres presented a bioactive behaviour and high values of shape fixity and shape recovery confirmed the shape memory behaviour of the spheres triggered by hydration. The spheres were able to incorporate and release a drug model molecule. These spheres demonstrated to be attractive as bioactive multifunctional biomaterial for bone-related therapies.

**References:**

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